## Claims

WHAT IS CLAIMED IS:

1. An apparatus for controlling an electromagnetic valve actuator having an armature positioned between open and close coils comprising:

a position processor for generating an energy signal and open and close timer signals in response to a position signal representing a position of a valve actuator armature relative to open and close coils;

a current controller for generating a final current command signal and a normalized energy signal in response to said energy signal;

an event generator for generating event signals in response to said open and close timer signals and said normalized energy signal; and

a supervision logic controller for generating initialization and transition signals in response to said final current command signal and said event signals, said initialization and transition signals defining current pulse magnitude and duration for soft seating of the armature on a seating surface of cores associated with the open and close coils.

2. The apparatus according to claim 1 wherein said position processor includes means for differentiating said position signal to obtain a speed signal representing a speed of the armature and means responsive to said position signal and said speed signal for generating said energy signal representing a total mechanical energy of the armature.

3. The apparatus according to claim 1 wherein said position processor includes means for normalizing said open and close timer signals utilizing one half of a natural transition time of the armature.

4. The apparatus according to claim 1 wherein said current controller includes means for normalizing said energy signal based upon a selected maximum potential energy to generate said normalized energy signal.

5. The apparatus according to claim 1 wherein said current controller includes a look-up table storing values of the maximum energy that can be injected into the armature for a plurality of values of current pulses, means for estimating a total energy loss based upon the position of the armature and command means responsive to a maximum energy value obtained from said look-up table and said total energy loss for generating said final current command signal.

6. The apparatus according to claim 5 wherein said command means generates said final current command signal by scaling and limiting.

7. The apparatus according to claim 1 wherein said event generator responds to said timer close signal to generate a cls_app signal when the armature is released from a valve open position and passes a middle point between the valve open position and a valve closed position, said supervisor logic controller being responsive to said cls_app signal to generate one of said initialization signals for starting a current pulse in the close coil.

8. The apparatus according to claim 7 wherein said event generator controller responds to said timer close signal to generate a cls_set signal for stopping said current pulse.

9. The apparatus according to claim 1 wherein said supervision logic controller generates said initialization and transition signals to define at least one higher magnitude current pulse to draw the armature toward one of the coils, followed by a predetermined period of no current pulse, followed by a lower magnitude holding current pulse.

10. The apparatus according to claim 9 wherein a magnitude of said holding current pulse is just sufficient to overcome friction present during seating of the valve.

11. The apparatus according to claim 1 wherein said current controller includes means for generating a difference signal representing a difference between a seating energy value and a full system energy value and adding said difference signal to said final current command signal.

12. A method for controlling an electromagnetic valve actuator having an armature positioned between open and close coils comprising the steps of:

a. generating a final current command signal in response to a position signal representing a position of a valve actuator armature relative to open and close coils;

b. generating a first signal in response to said final current command signal defining a higher magnitude current pulse of predetermined duration to draw the armature toward the one of the coils;

c. generating a second signal in response to said final current command signal defining a predetermined period of no current pulse; and

d. generating a third signal in response to said final current command signal defining a lower magnitude holding current pulse for soft seating of the armature on a seating surface of a core associated with the one coil.

13. The method according to claim 12 wherein said step a. is repeated at least once after said step b. is performed.

14. The method according to claim 12 wherein the one coil is the close coil and the lower magnitude is just sufficient to overcome friction present during seating of the valve.

15. The method according to claim 12 wherein said step a. is performed by differentiating a position signal representing a position of the armature relative to the coils to obtain a speed signal representing a speed of the armature, obtaining a total mechanical energy of the armature from the position signal and the speed signal and generating the final current command signal based upon the total mechanical energy of the armature.

16. The method according to claim 12 wherein said step a. is performed by obtaining from a look-up table a value of a maximum energy that can be injected into the armature for an associated value of current pulse, estimating a total energy loss based upon the position of the armature and generating the final current command signal command based upon the maximum energy value and the total energy loss.

17. The method according to claim 11 wherein said step a. includes adding to the final current command signal a difference signal representing a difference between a seating energy value and a full system energy value signal.